

Torrefaction Processing for Human Solid Waste Management, Phase II

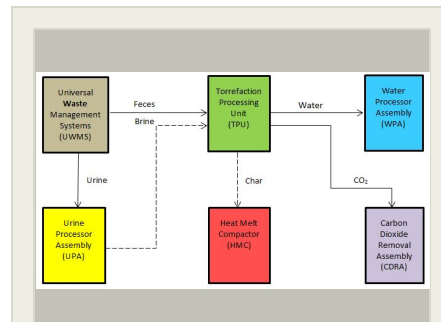
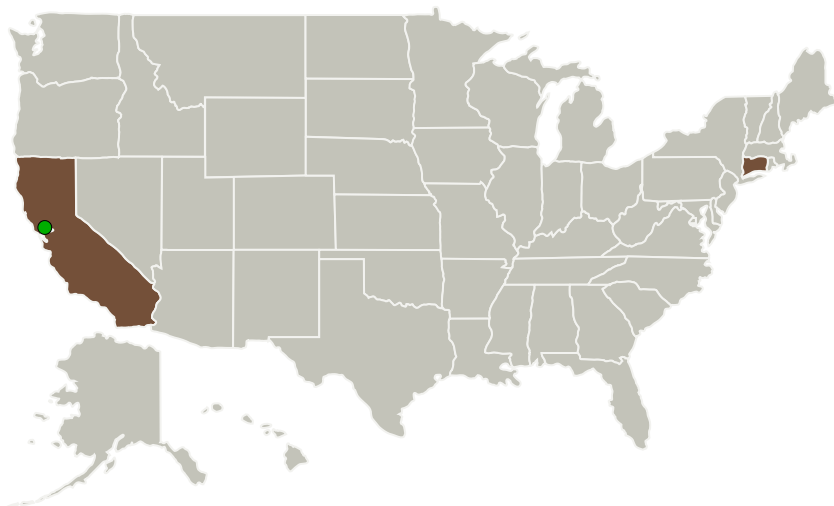
Completed Technology Project (2016 - 2020)



Project Introduction

The NASA SBIR Phase I project addressed the technical feasibility of an innovative torrefaction (mild pyrolysis) processing system that can be used to sterilize feces and produce a stable, odor-free solid product than can be easily stored or recycled, while simultaneously recovering moisture and producing small amounts of other useful products. The Phase I project demonstrated that mild heating (200-250 C) was adequate for torrefaction of a fecal simulant and other analogs of human solid waste (canine feces). The net result was a nearly undetectable odor, complete recovery of moisture, some additional water production, a modest reduction of the dry solid mass and the production of small amounts of gas (mainly CO₂) and liquid (mainly water). The amount of solid vs gas plus liquid products can be controlled by adjusting the torrefaction conditions (final temperature, holding time). The solid product was a dry material that did not support microbial growth and was hydrophobic relative to the starting material. In the case of canine feces, the solid product was a mechanically friable material that could be easily compacted to a significantly smaller volume (~50%). In addition, the torrefaction method can be applied using the same or similar conditions to other types of wet solid wastes and is compatible with the Universal Waste Management System (UWMS), now under development by NASA. The torrefaction process could also be accomplished with minimal crew interactions and modest energy requirements, which could be improved even further in an optimized and innovative Phase II Torrefaction Processing Unit (TPU), which is the objective of the current proposal.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Advanced Fuel Research, Inc.	Lead Organization	Industry	East Hartford, Connecticut
● Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations

California	Connecticut
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Project Transitions

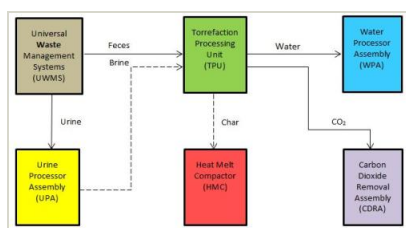
▶ **June 2016:** Project Start

✓ **December 2020:** Closed out

Closeout Documentation:

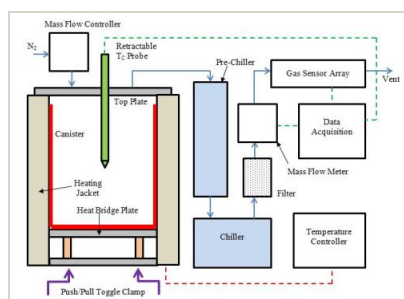
- Final Summary Chart(<https://techport.nasa.gov/file/138543>)

Images



Briefing Chart Image

Torrefaction Processing for Human Solid Waste Management, Phase II (<https://techport.nasa.gov/image/134127>)



Final Summary Chart Image

Torrefaction Processing for Human Solid Waste Management, Phase II (<https://techport.nasa.gov/image/131226>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Advanced Fuel Research, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Michael A Serio

Co-Investigator:

Michael Serio

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Technology Maturity (TRL)

Start: 4
Current: 6
Estimated End: 6



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
 - └ TX06.1 Environmental Control & Life Support Systems (ECLSS) and Habitation Systems
 - └ TX06.1.3 Waste Management

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System